

Effect of the Opening of Central Circular Shinjuku Route (Yamate tunnel): An Analysis

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ABSTRACT

The Metropolitan Expressway's Central Circular Route runs innermost of the three major Ring Roads in Greater Tokyo. Central Circular Shinjuku Route (Yamate Tunnel), the 6.7-kilometer section of the route, was opened to traffic on December 22, 2007 in addition to its eastern and northern sections (33 kilometers).

The major role of this route is to allow drivers to avoid the central area district. It is expected that the inauguration of the route will contribute to ease the heavy traffic congestion in Central Tokyo.

In this paper, analysis on the effect of the Yamate Tunnel inauguration focusing on the service level of Metropolitan Expressway, based on various kinds of traffic data, is described. The results show that the tunnel inauguration produced significant improvements in the traffic conditions on Metropolitan Expressway, such as mitigation of the total traffic congestion, reduction of the travel time on certain routes, and decrease in traffic accidents.

1. INTRODUCTION

In the Tokyo area, construction has been completed on expressways linking Tokyo to other urban areas, including the Tomei Expressway, Chuo Expressway, and Tohoku Expressway, as well as portions of the Metropolitan Expressway system which link them radially. However, it is the Inner Circular Route (C1) only that circularly connects these expressways. As a result, traffic tends to become concentrated on the Inner Circular Route, which leads to chronic congestion.

As a fundamental solution to this problem of congestion, it is urgently necessary to complete additional beltways for the suitable diversion and dispersion of through traffic. Work is underway to construct an expressway network with three beltways: the Central Circular Route (C2) of the Metropolitan Expressway, which lies about 8 kilometers from central Tokyo; the Tokyo Outer Ring Road (Tokyo Gaikan Expressway), about 15 kilometers from central Tokyo; and the Metropolitan Inter-City Expressway (Ken-o-do), 40 to 60 kilometers from central Tokyo.

The Central Circular Route, closest of these to the city center, will be a 47-kilometer beltway.

In addition to its completed eastern and northern sections (about 26 kilometers), its western section, the Central Circular Shinjuku Route(Yamate Tunnel), will measure about 11 kilometers. And the Central Circular Shinagawa Route which is the last southern section is about 10 kilometers.

The first portion of the Yamate Tunnel, a 6.7 kilometer section linking the Route 4(Shinjuku Route) and Route 5(Ikebukuro Route), was opened in December 2007(Figure 1). The Yamate Tunnel runs about 30 meters underground along the path of the Loop Route 6, which is known as Yamate Street.

In this paper, we report on the effects that have been observed during the first year after the Yamate Tunnel was opened, based on data from vehicle detectors installed on the Metropolitan Expressway, accident data from traffic control, and Internet surveys.

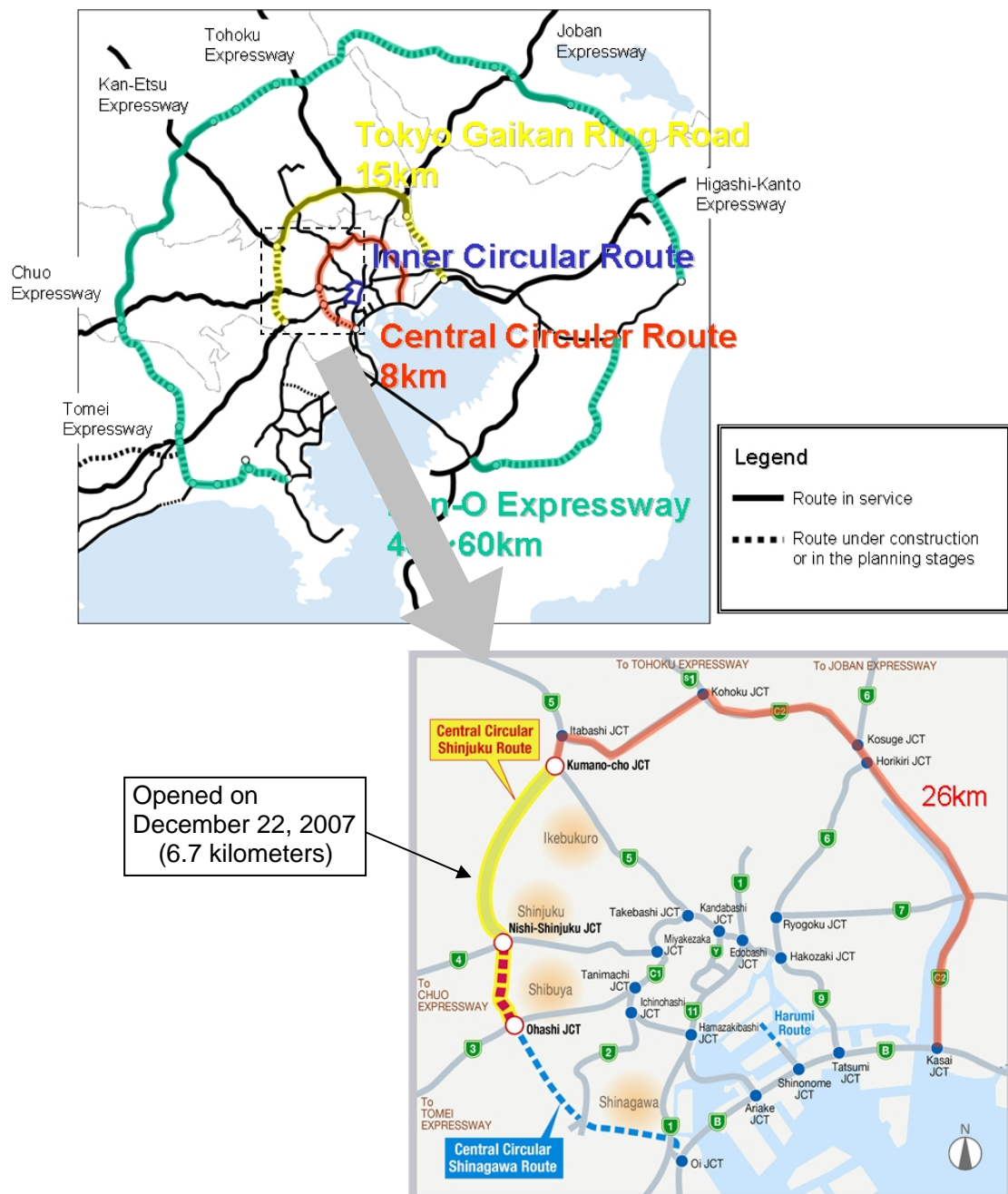


Figure 1. Expressway network in the Tokyo area

2. ROLE OF THE CENTRAL CIRCULAR ROUTE (C2)

As mentioned above, because of the delayed completion of beltways within the expressway network of the Tokyo area, traffic tends to become concentrated in one area. To travel from one radial route to another, it is generally necessary to take the Inner Circular Route (C1). About 60% of all traffic on C1 consists of through traffic, or vehicles which do not have destinations along C1 (Figure 2).

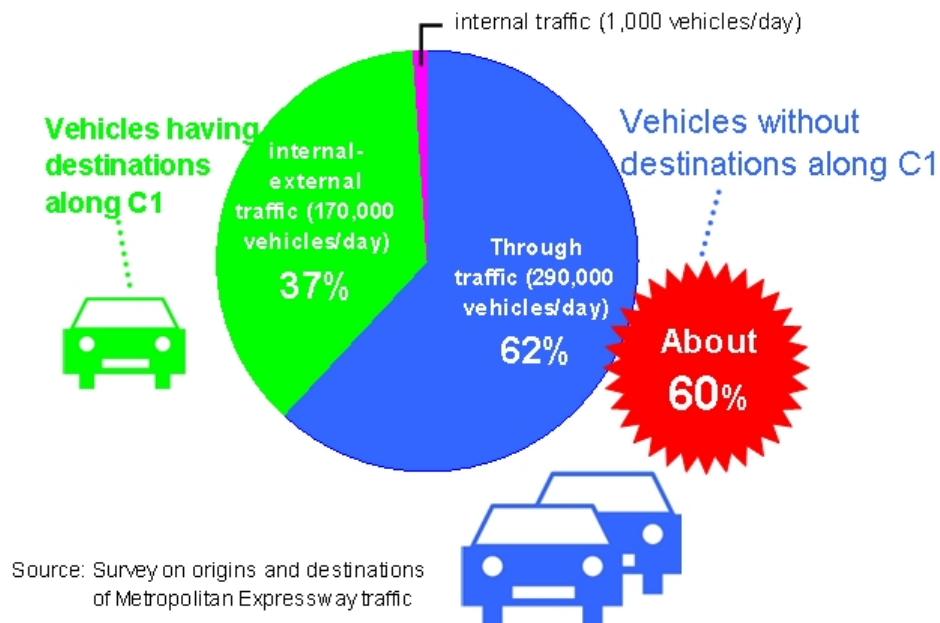


Figure 2. Traffic using the Inner Circular Route(C1)

With the opening of the Yamate Tunnel, through traffic can be diverted and dispersed, improving the overall flow of Metropolitan Expressway traffic and enabling efficient route selection (Figure 3).

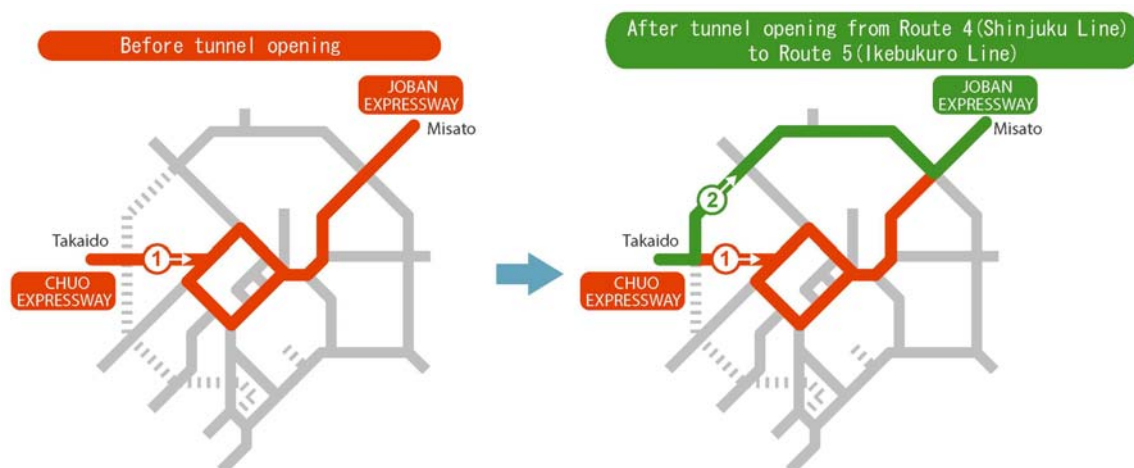


Figure 3. Efficient route selection

The diversion and dispersion of traffic is expected to reduce congestion on the Metropolitan Expressway and to provide important environmental and economic benefits.

3. CHANGES IN TRAFFIC AFTER OPENING OF THE YAMATE TUNNEL

A. Changes in traffic volume

While growth in the overall volume of Metropolitan Expressway traffic has been stagnant, traffic volume of the Yamate Tunnel has steadily climbed. In November 2008, traffic volume averaged about 37,500 vehicles per day, or about 80% of the estimated volume (Figure 4).

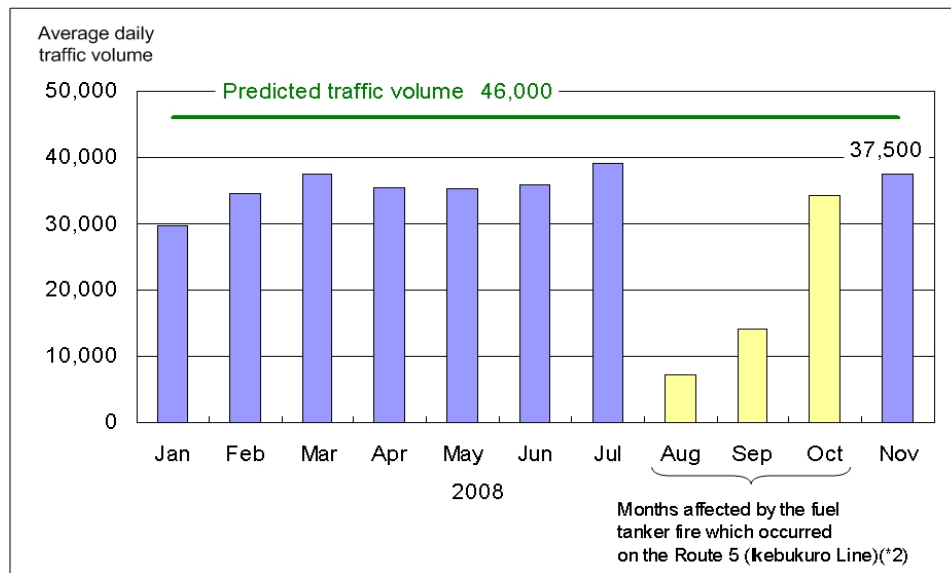


Figure 4. Trends in Yamate Tunnel traffic Volume

Comparing traffic volume before and after the Yamate Tunnel was opened, we see that traffic outside of C2 has increased, while traffic inside of C2 has decreased. This shift in traffic volume indicates that traffic has been diverted and dispersed (Figure 5).

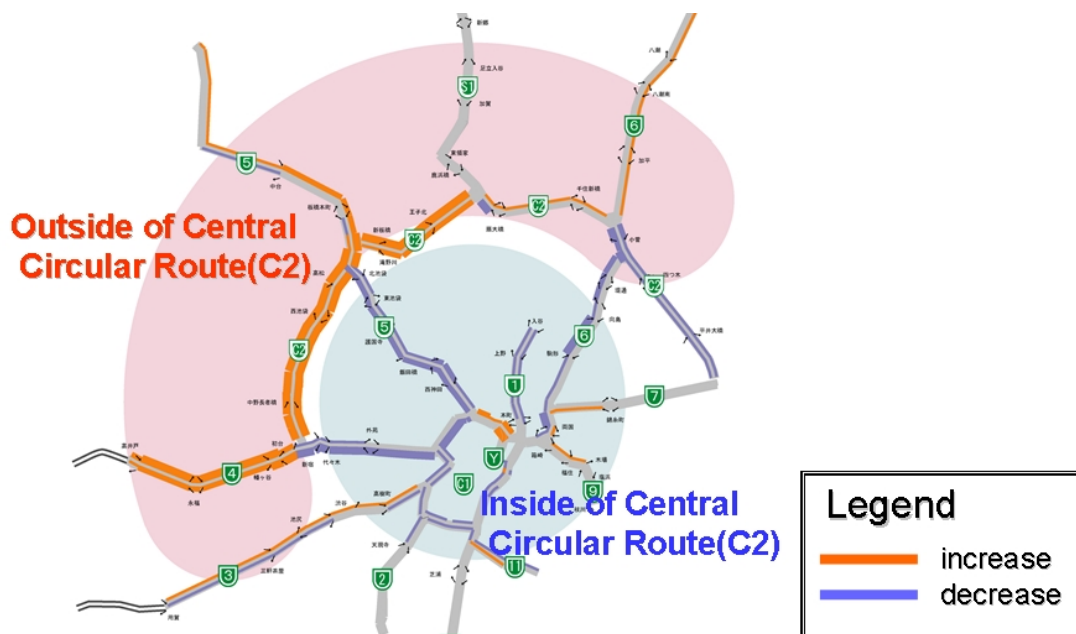


Figure 5. Traffic volume before and after the opening of the Yamate Tunnel

B. Changes in congestion

(1) Increase of "Smooth traffic flow" hours

As traffic has been diverted and dispersed, congestion has declined. There has been a particularly significant improvement on the Route 4(Shinjuku Route) in the direction toward central Tokyo. With improved travel speeds, smooth traffic flow (average speed of 40 km/h) now occurs on this portion for five additional hours per day, and the travel time has decreased at all times of day (Figure 6).

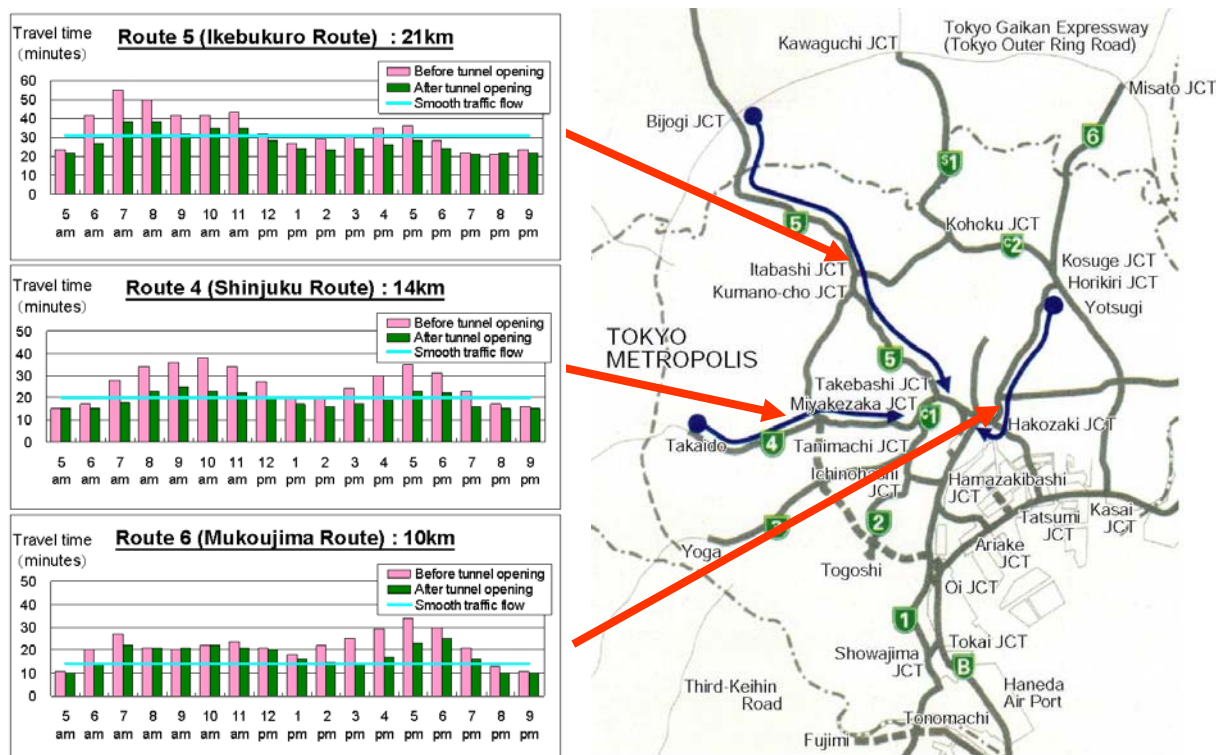


Figure 6. Changes in travel time, by time of day

(2) Reduction of the irritation by congestion

From January to July, the length of congestion during the peak weekday hour (at 11 am) declined by an average of 26% compared to the same month of the previous year, before the tunnel was opened. This trend was again seen in November, after the effects of the tanker fire on the Route 5(Ikebukuro Route) had been eliminated (Figure 7). This has surely reduced the irritation of congestion. Figure 8 shows the changes in congestion by route during the peak weekday hour (at 11 am).

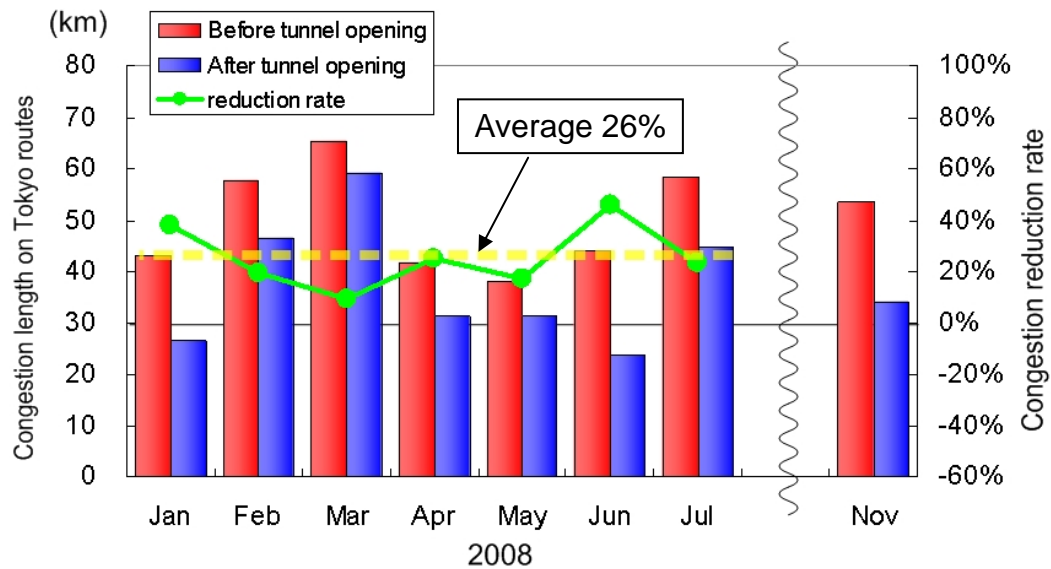


Figure 7. Changes in congestion length during the peak weekday hour (at 11 am)

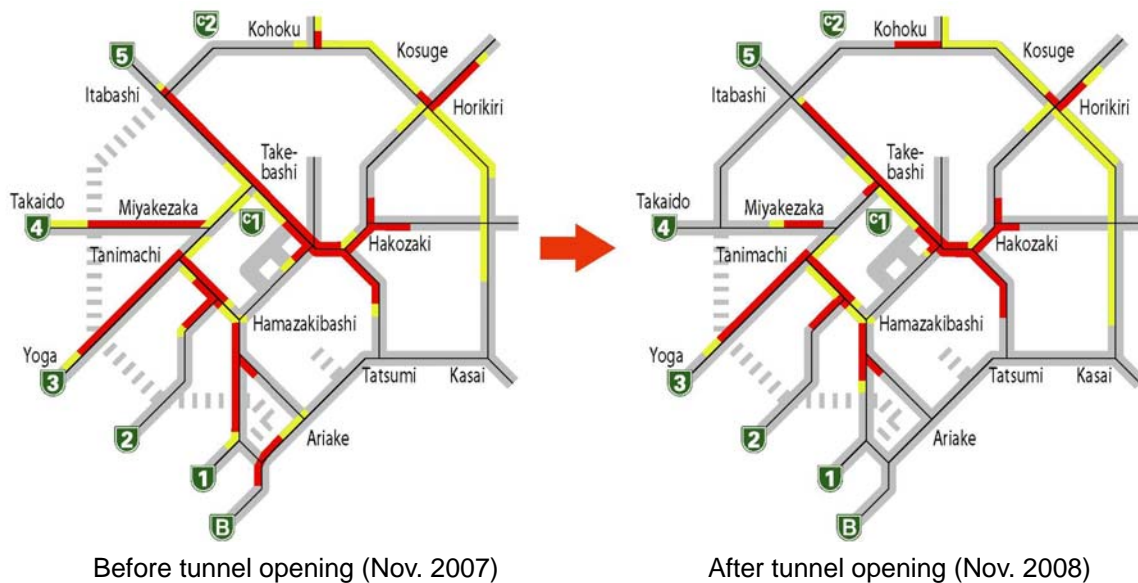


Figure 8. Changes in congestion by route (November 2007 vs. November 2008)

(3) Greater consistency in travel time

The required travel time has decreased and become more consistent. As shown in Figure 9, the average travel time from Takaido (Chuo Expressway) to Misato (Joban Expressway) was reduced by 14 minutes after the Yamate Tunnel was opened. In addition, the maximum travel time was reduced by 33 minutes, resulting in a smaller difference in travel time depending on the time of day of departure. This means that it will be easier for commuters and leisure travelers to estimate the required time and make accurate plans.

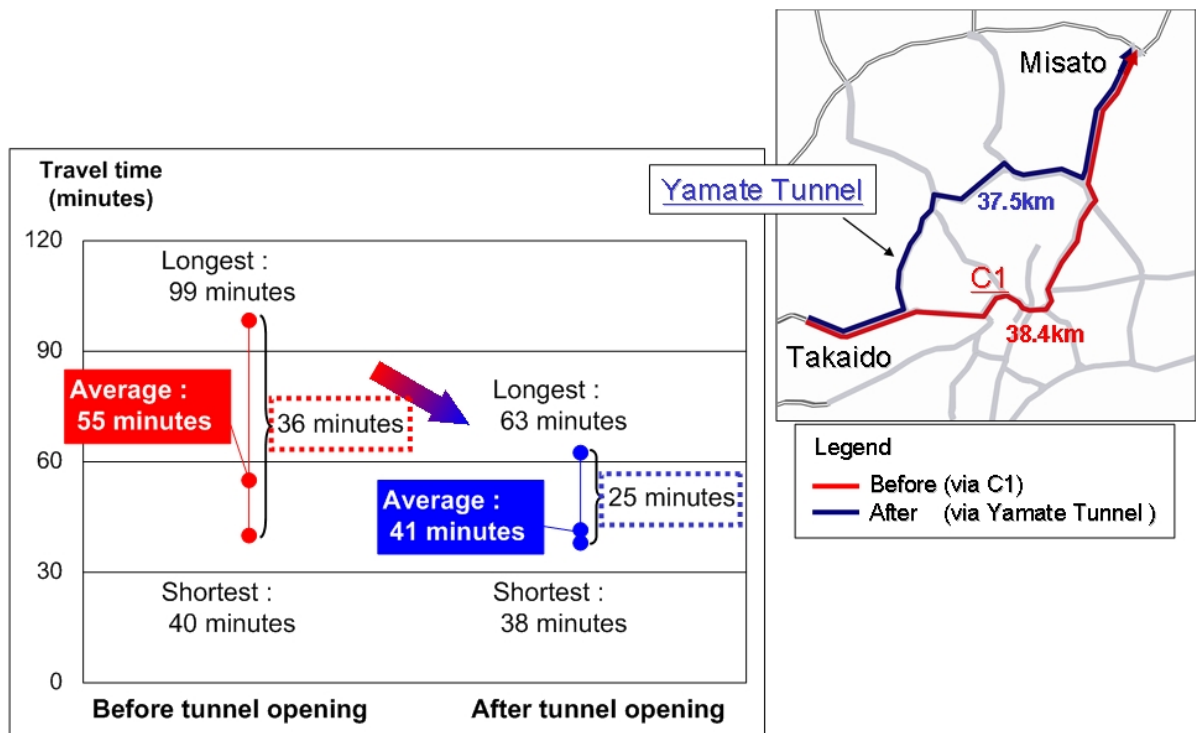


Figure 9. Changes in travel time (Takaïdo to Misato)

(4) Fewer rear-end collisions in congested traffic

With reduced congestion on the Route 4(Shinjuku Route) in the direction toward central Tokyo, there has been a 40% reduction in rear-end collisions occurring within a line of vehicles in congested traffic, indicating greater ease of driving (Figures 10 and 11).

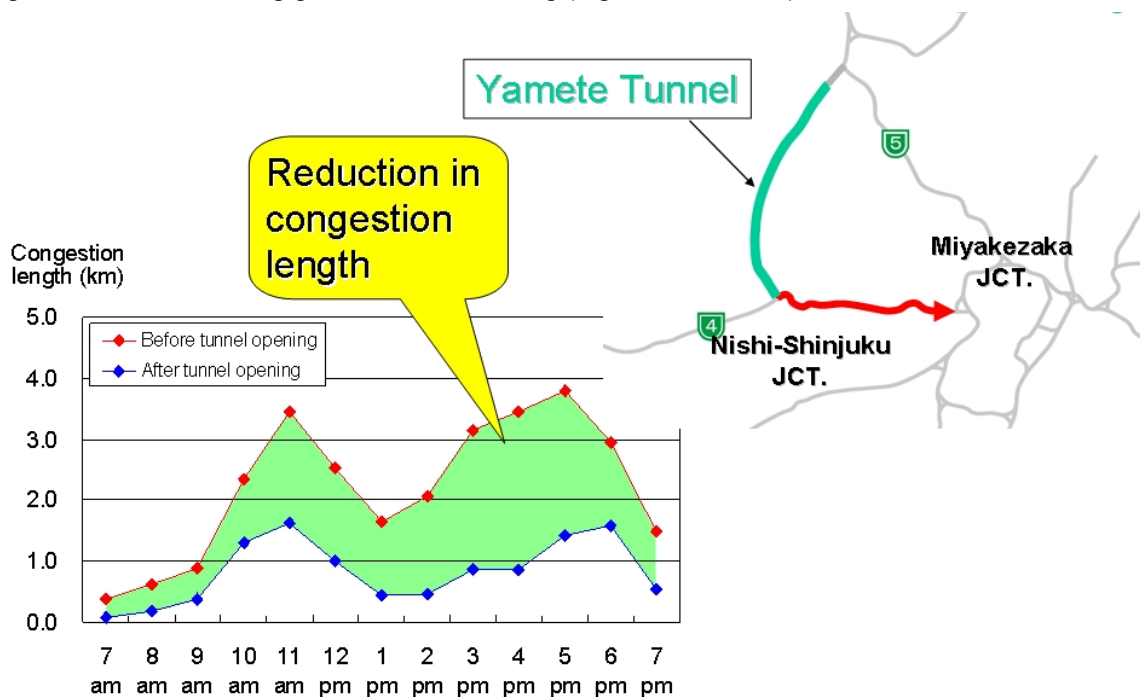


Figure 10. Congestion length by time of day

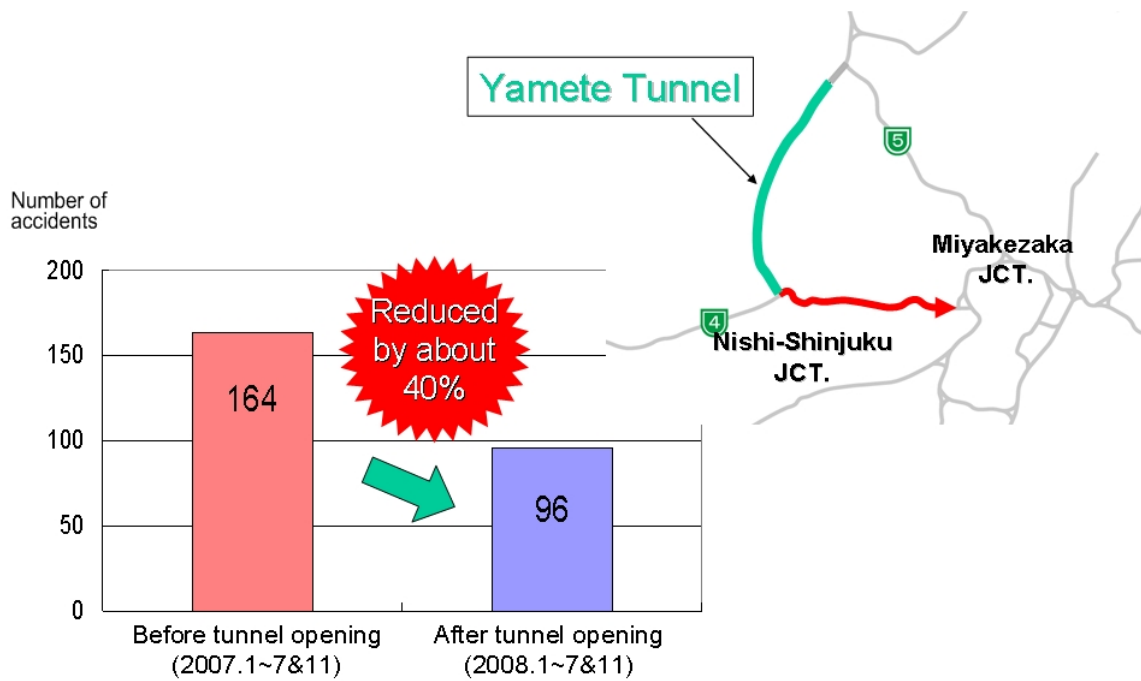


Figure 11. Traffic accidents before and after the Yamate Tunnel was opened

4. DRIVER RESPONSES FROM INTERNET SURVEY

A. Survey summary

The survey was conducted to determine the usage situation of the Yamate Tunnel. Respondents were drivers from four prefectures (Tokyo, Saitama, Chiba, and Kanagawa) who had used the Metropolitan Expressway between January and May 2008, balanced by genders and age groups.

Survey period : May 8-10, 2008

Sample size : 1,344 respondents

B. Survey results

Figure 12 shows how drivers responded when asked what actual changes they have noticed as a result of the opening of the Yamate Tunnel. About 27% felt that the required travel time had decreased, and about 17% felt that the Metropolitan Expressway was less congested than before.

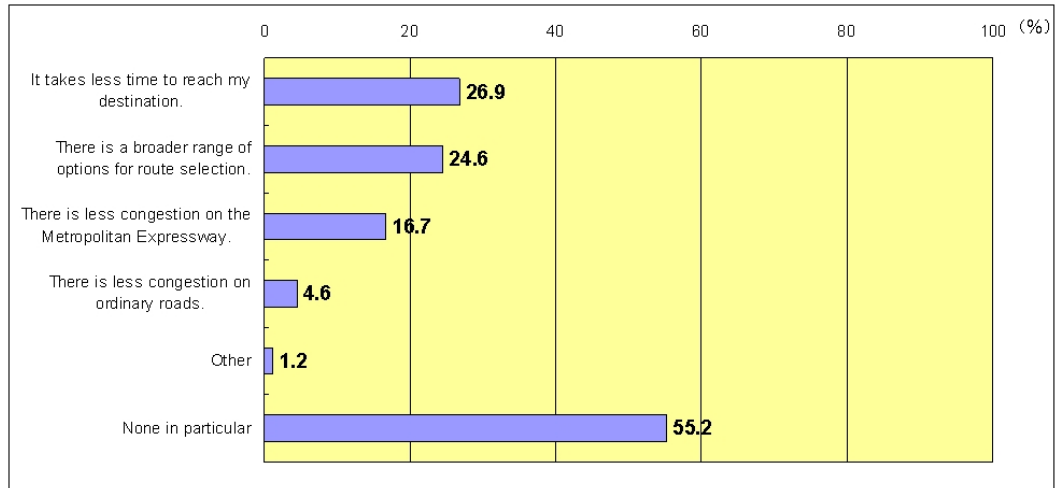


Figure 12. Changes noticed as a result of the opening of the Yamate Tunnel

If a respondent stated that "There is less congestion on the Metropolitan Expressway" when answering the preceding question, they were then asked which routes have less congestion. About half indicated that the Inner Circular Route (C1) and the Route 5(Ikebukuro Route) were less congested, and about 37% indicated that the Route 4(Shinjuku Route) was less congested. This is in accordance with the figures from actual traffic measurements (Figure 13).

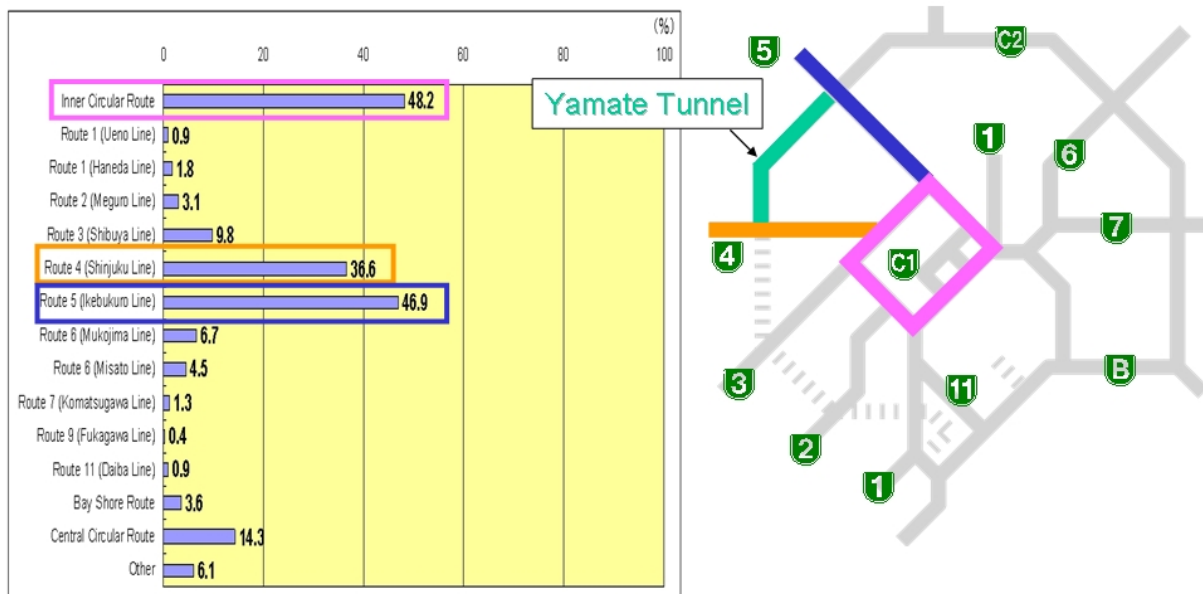


Figure 13. Routes where drivers noticed lower congestion

Similar reactions were also obtained in an interview survey conducted in a parking area immediately after the tunnel was opened. A truck driver stated, "There is a great time reduction compared to other routes, and this improves operating efficiency." A company employee commented, "Traffic was really smooth and comfortable." A female driver said, "It seems as though congestion is lower on other portions of the Metropolitan Expressway as well."

5. CONCLUSIONS

The Yamate Tunnel (linking the Route 4(Shinjuku Route) and the Route 5(Ikebukuro Route)) was opened nearly a year and a half ago. Since that time, circumstances such as soaring gasoline prices and a fuel tanker fire which occurred on Route 5 have made it difficult to directly measure the effects of tunnel opening. However, in the course of continuous data monitoring, it has become clear that the opening of the Yamate Tunnel has resulted in significant benefits for the Metropolitan Expressway.

In the future, we plan to verify whether the proportion of through traffic using the Inner Circular Route (C1) has been reduced from the 60% level, as mentioned at the beginning of this report, and to analyze the environmental benefits and economic effects of the tunnel.

The remaining 4.3-kilometer section of the Yamate Tunnel, extending from the Route 3 (Shibuya Route) to the Route 4 (Shinjuku Route), is scheduled to be opened in March, 2010. Next, the Central Circular Shinagawa Route, which is the last remaining section of the Central Circular Route (C2), is scheduled to be opened in FY 2013.

It is anticipated that interest will continue to grow regarding the effects of improvements on the Central Circular Route, and we are planning to engage in further studies to verify these effects.

REFERENCES

- 1 Report of the 25th survey on origins and destinations of Metropolitan Expressway traffic
- 2 For more information concerning the fuel tanker fire on the Route 5(Ikebukuro Route):
<http://www.shutoko.jp/route5/index.html>